
2011
Annual Report
NOAA's
National Climatic Data Center
Protecting the past... Revealing the future

As the steward of the Nation's climate information, NOAA's National Climatic Data Center conducts climate research, develops climate products, provides access to climate data, and provides regular analyses on the climate in the United States and the world.

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Billion-Dollar Weather and Climate Disasters 2011


Length of Service Recognition
25 Years
30 Years
NOAA

Letter from the Director

Throughout 2011, NOAA's National Climatic Data Center (NCDC) proved to be the trusted authority on weather and climate information that the Nation needed. Even in a time of tightening budgets, NCDC remained focused on its core competencies and produced the best available products to meet the needs of our constituents and the public.

NCDC remains the world's largest archive of climate information, with a digital archive containing 6,500 terabytes in 2011. 6,500 terabytes equates to one Kindle book for each of the 7.1 billion people on Earth. NCDC also delivered over 1,000 terabytes of data electronically to users throughout the year. As the importance of climate information to make decisions grows in areas such as agriculture, energy, and city planning, NCDC continues to increase its suite of climate services for the Nation.

In 2011, NCDC released the once-a-decade update to the Climate Normals as well as a new version of the Global Historical Climatology Network-Monthly dataset. NCDC also released five new satellite-based operational Climate Data Records, which provide objective climate information from weather satellite data that NOAA has collected for more than 30 years.

This report highlights these and other key accomplishments from NCDC as we carry out critical climate science, develop new and better applications to enable climate data access, and monitor our changing planet. None of this work could be accomplished without the dedication of the NCDC staff and team members and collaboration with our partners.

Every day, governments, businesses, and individuals make long-term decisions—affecting lives and livelihoods—that require an accurate understanding of the natural environment. NCDC's world-class team dedicates itself to deciphering the state of our climate for you and the Nation and to preserving climate information for generations to come.

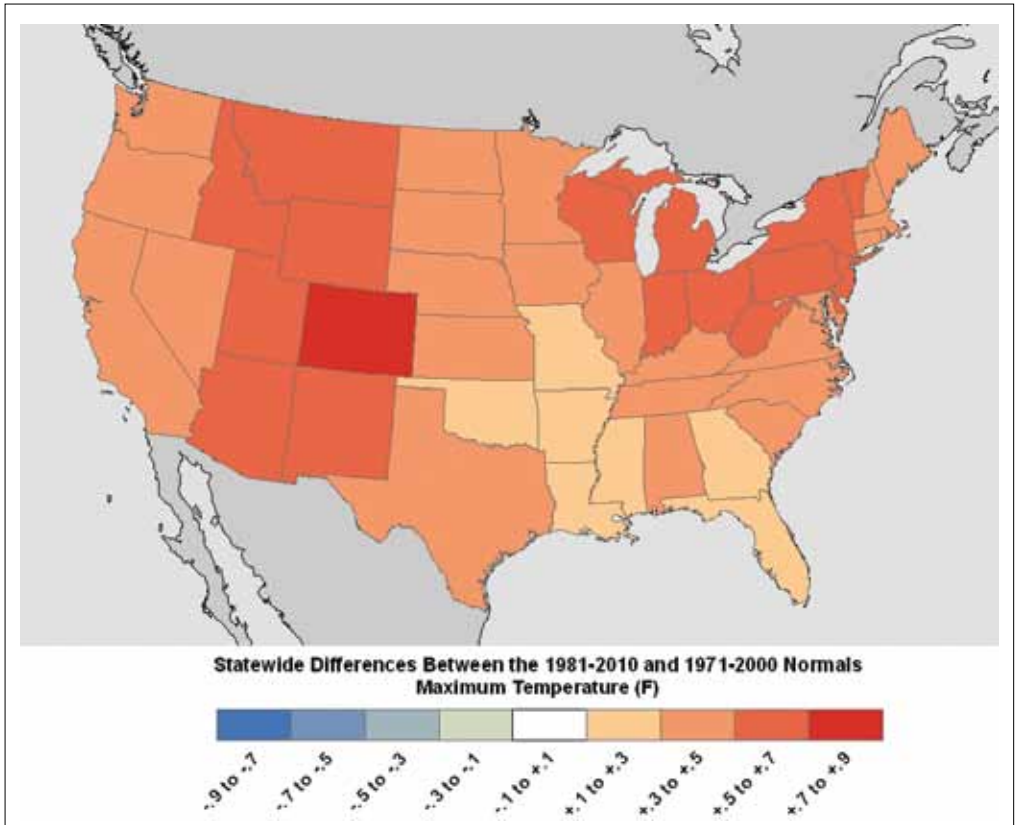
Thomas R. Karl

Engineering the 1981–2010 Climate Normals

In 2011, NCDC released the 1981–2010 Climate Normals. Climate Normals are three-decade averages of numerous climatological variables, most notably temperature and precipitation. Normals serve as a point of reference for "typical" climate conditions at a given location. This once-a-decade release updated the Normals for more than 7,500 locations across the United States. Over 1,000 new stations are included in the new Normals.

NCDC produced hourly, daily, monthly, seasonal, and annual Normals for numerous climatological variables including temperature, precipitation, and snowfall. NCDC also computed Normals for derived quantities such as heating and cooling degree-days and the number of days per month above or below certain thresholds. NCDC made many improvements and additions to the scientific methodology used to calculate the 1981–2010 Normals. Examples include improved scientific quality control and statistical techniques. NCDC also provided full-scale user engagement before and after releasing the Normals and incorporated new products based on stakeholder feedback.

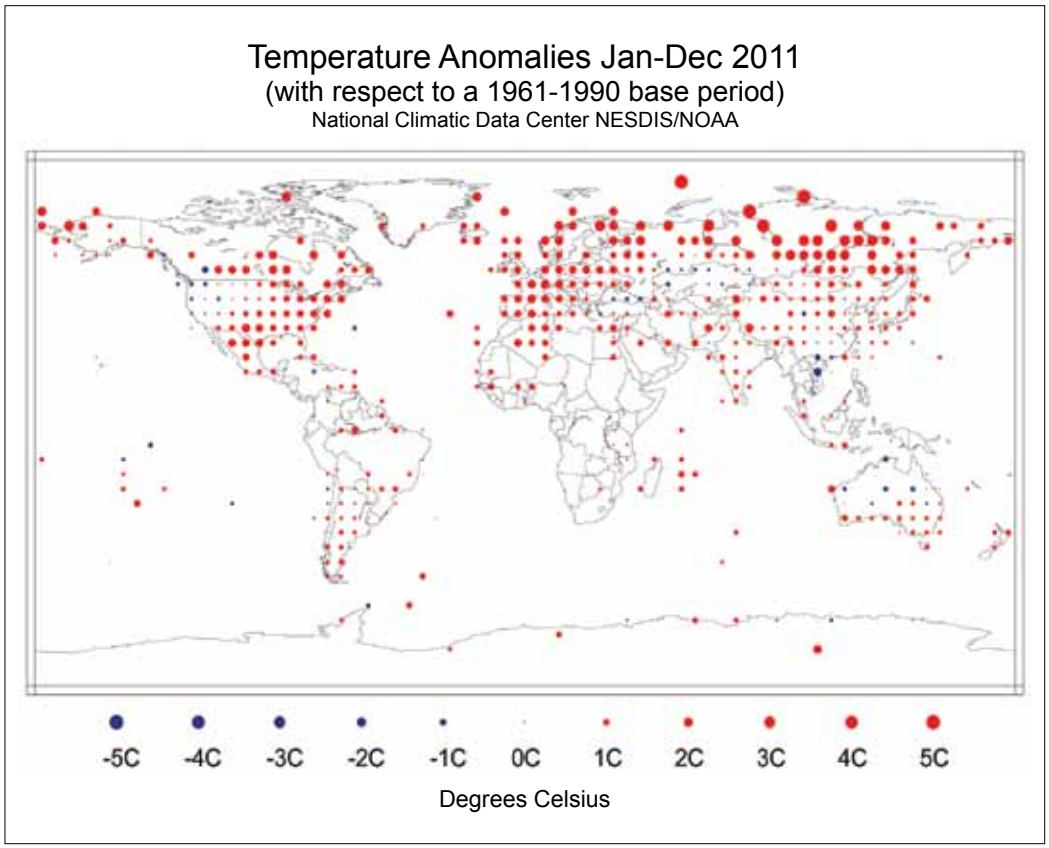
Numerous stakeholders use NOAA's Climate Normals. For instance, builders, insurers, and engineers use Normals for planning and risk management. Energy companies use Normals to predict fuel demand. Farmers rely on Normals to help make decisions on both crop selection and planting times. Agribusinesses use Normals to monitor "departures from normal conditions" throughout the growing season and to assess past and current crop yields. Normals are also commonly seen on TV weather segments for comparisons with the day's weather conditions.



On July 1, 2011, NCDC released the 1981–2010 Normals. Climate Normals are the latest three-decade averages of climatological variables, including temperature and precipitation. This new product replaces the 1971 Normals products.

Developing the Global Historical Climatology Network-Monthly Version 3 Monthly Mean Temperature Dataset

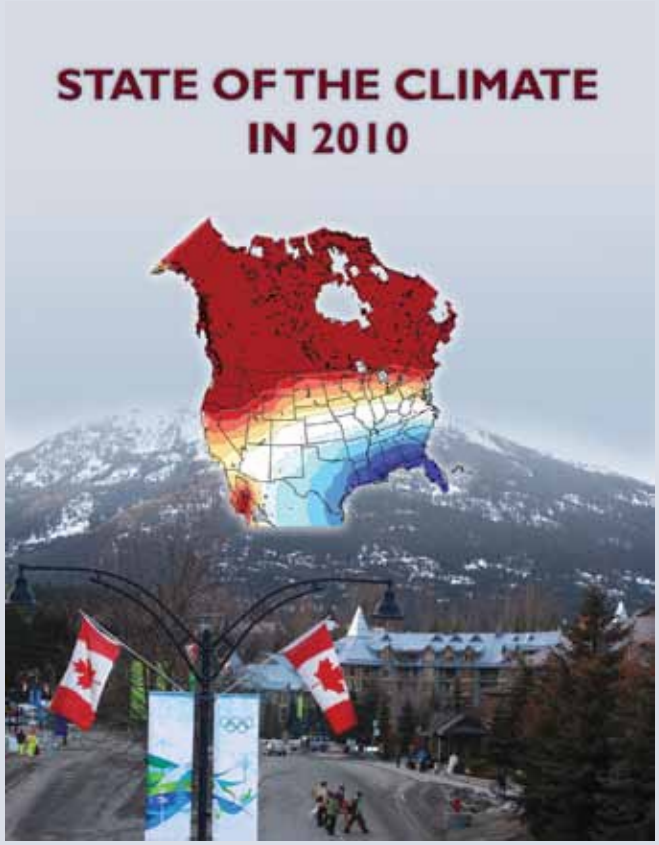
Since the early 1990s, the Global Historical Climatology Network-Monthly (GHCN-M) dataset has been an internationally recognized source of data for the study of observed variability and change in land surface temperature. It provides monthly mean temperature data for 7,280 stations from 226 countries and territories, ongoing monthly updates of more than 2,000 stations to support monitoring of current and evolving climate conditions, and homogeneity adjustments to remove non-climatic influences that can bias the observed temperature record.



The release of Version 3 Monthly Mean Temperature Data marks the first major revision to this dataset in over ten years. It introduces a number of improvements and changes that include consolidating "duplicate" series, updating records from recent decades, and the use of new approaches to homogenization and quality assurance.

NCDC developed new quality control methodologies and applied a new homogeneity adjustment algorithm to extend and improve bias corrections to *in situ* stations on every continent. NCDC also developed a new update system to ensure all updates to source datasets can be incorporated immediately and established a version control and data provenance system to improve the traceability of data. Additionally, NCDC made other changes in response to user requests to broaden the use of this dataset to a wider community. Overall, this effort provides a global dataset of higher quality for diverse user communities. The data are easier to access, easier to understand, and more complete.

Leading Development of the 2010 *Bulletin of the American Meteorological Society* State of the Climate Report



NOAA began the State of the Climate series (as Climate Assessment) in 1990, and the report has grown in scope to become a leading, anticipated publication. It is unique among annual major assessments in that it does not attempt to validate models or make projections of future climate conditions. It is strictly built upon data compiled in the world's agencies and academic institutions—the climate system's vital signs.

NCDC led the document from its commissioning in fall 2010, providing high-level oversight, recruiting editorial leadership, editing, copy-editing, designing the layout, and producing companion materials to make the document more accessible to the public. This edition was the broadest to date in terms of authors providing datasets and/or analyses (362 authors from 45 countries) and number of climate indicators tracked (global or partial coverage of 41 Essential Climate Variables).

The report provides a peer-reviewed annual "physical" of the climate system and insights into our capacity to measure it, using trusted sources of information. This evaluation helps to clarify and quantify climate change and variability in the face of a dissonant communications environment for climate issues. The companion materials distill major points and further portray the interconnected relationships within the physical climate system.

Releasing Five New Satellite-Based Operational Data Records

In 2011, NCDC delivered five new operational Climate Data Records (CDRs) including Microwave Sounder, Microwave Imager, Aerosol Properties, Outgoing Longwave—Top of Atmosphere, and Sea Surface Temperature, bringing the total of satellite-based operational CDRs at NCDC to eight. By capturing and securing the ability to produce these CDRs within NOAA's operational framework, great value has been added to NOAA's archive of satellite observations. Societal benefits of these CDRs include improved precipitation estimates for agriculture, improved human health forecasts/outlooks for pollutants, better estimates of surface temperature trends, improvements in fisheries impacts analyses, and hydrological outlooks for water managers that are more timely and accurate. NCDC plans to integrate products in addition to satellite data into CDRs in the coming years. These include merged products like combined satellite and radar observations, ground-based observations, and other types of climate records.

KEY CLIMATE DATA RECORD PROGRAM ACCOMPLISHMENTS IN 2011

- Developed new operational CDR documentation and coding standards that enable NCDC to increase productivity and efficiency of transitioning CDRs from development into operational products
- Awarded four new competitive grants bringing the total number of grants to 18; these grants enable NCDC to transition developmental CDRs in the academic setting into robust, operational, and publicly accessible CDRs
- Redesigned the CDR website to allow the public to track the progress of CDR grants, view relevant project management documents, and coordinate with CDR scientists as well as to provide open and free access to all data and documentation and show how these CDRs benefit society

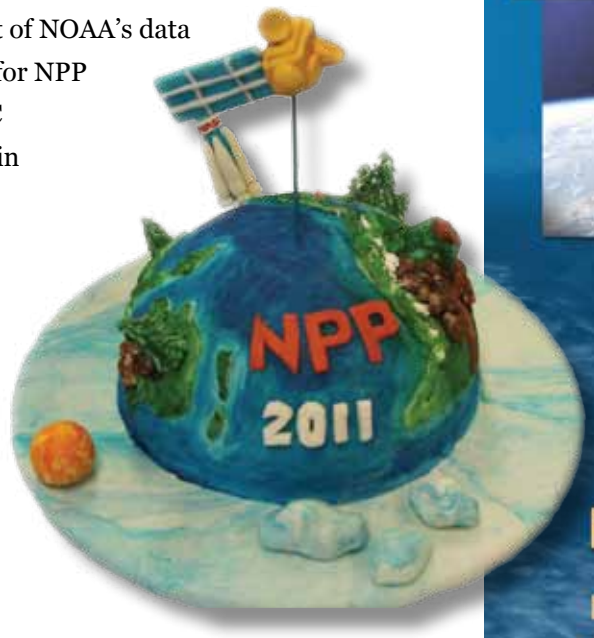
NOAA's Climate Data Record Program at the National Climatic Data Center is leading NOAA's generation of satellite operational climate records for the atmosphere, oceans, and land.

Our mission is to affordably provide authoritative satellite climate records that allow our Nation to successfully adapt to a changing environment.

It is NOAA's vision that climate records extend from the start of the satellite era far into the future as trustworthy measures of climate change and variability.

Assuring Launch Readiness of NASA's Suomi National Polar-orbiting Program Satellite

As the only designated archive of the Suomi National Polar-orbiting Program (Suomi NPP) satellite's data, and a key component of NOAA's data distribution scheme for NPP data products, NCDC played a critical role in the NASA-led testing of the ground system in support of NPP. NCDC personnel successfully completed all scheduled testing and participated in many other unplanned tests leading up to full mission readiness. NCDC personnel supported a full range of rigorous reviews and technical discussions leading to the successful certification of the ground system as ready for launch. NCDC's work contributed to the timely launch of Suomi NPP, the data from which will provide great benefits to NOAA and the public.



Facilitating Accessibility to Climate Model Data

Numerous NCDC customers have requested easy access to Climate Forecast System (CFS) data for a variety of applications, from downscaling to using the data to drive coupled ecosystem models. These requests prompted NCDC to ingest and archive CFS reforecast historical data (Jan 1979–Mar 2011) from the National Center for Environmental Prediction as well as to make it accessible via the National Model Archive and Distribution System (NOMADS) from the Comprehensive Large Array-data Stewardship System (CLASS). NCDC staff also provided stewardship and quality control functions to ensure the climate model data archive was accurate and complete. Completion of this project now allows easy access to CFS data. For the public and scientific community, the climate model data are now openly and freely available for a multitude of uses.

Brazos River runs dry in Knox County, Texas, in summer 2011
By Earl Nottingham, © Texas Parks & Wildlife Department

Addressing Constituent Needs for Information on the Southern Plains Drought

To address ongoing constituent needs for information concerning the severe 2011 Southern Plains drought, NOAA's Regional Climate Services Director–Southern Region, David Brown, in partnership with the National Weather Service and the National Integrated Drought Information System, moderated several Southern Plains webinars on drought management in 2011 and hosted two major forums on Southern Plains Drought Assessment and Outlook. Through these six webinars and two meetings, officials from five agencies provided their expertise to over 260 participants and began building a sustained network of NOAA climate products and information users responding to climate-driven management challenges, including drought. These events gave decision makers and stakeholders representing several sectors including water resources, agriculture, livestock, forestry, wildfire management, and state and local government the information and tools to make informed decisions about the drought.

These webinars and forums greatly expanded the visibility of NOAA's regional climate services, and decision makers and stakeholders now have a better understanding of NOAA as a source for timely and accurate climate information. In addition, the 2011 sustained public engagement furthered collaboration on regional climate services, solidified existing relationships, and fostered new ones, including nontraditional partners such as cattle ranching trade groups in Texas. This effort has also identified new opportunities for research and product development to support drought management and other region-specific hazards.

Supplying Real-Time Regional Climate Information to the Missouri River Basin

The Climate Prediction Center's seasonal climate outlooks indicated a reoccurring La Niña-related risk of flooding in the Missouri River Basin that prompted scientists from NOAA's Earth System Research Laboratory, NOAA's Central Region, and the National Climate Predictions and Projections Platform (NCPP) to supply real-time regional climate information for a pilot project for the Missouri River Basin in coordination with state climatologists and local organizations. This project is also providing monthly climate outlook webinars to federal, tribal, state, and local governments, businesses, and the media.

The first two collaborative webinars for this project, held in late 2011 and moderated by NOAA's Regional Climate Services Director–Central Region, Doug Kluck, helped develop content to assist water managers, levee control boards, agricultural decision makers, energy providers, and emergency responders in planning for and early warning of potentially catastrophic extreme events. These webinars continued into 2012 through the snowmelt/runoff season.

The products and information developed in this project will be instrumental to federal, tribal, and state agencies such as FEMA in preparing and understanding impacts from extreme events as well as establishing a mechanism to reach out to constituents when the next climate event is forecast in the basin.

Missouri river images taken by the National Weather Service during a recent aerial fly over many of the affected areas of the May flooding

Expanding the U.S. Climate Reference Network in Alaska

The U.S. Climate Reference Network (USCRN) expansion in Alaska progressed in 2011 with the completion of a set of surveying, building, and commissioning activities that work around the short summer building season in Alaska toward the eventual full expansion of the network across Alaska. Two new USCRN sites in Alaska at Red Dog Mine and Kenai were commissioned in 2011, bringing the total number of commissioned USCRN sites in Alaska up to four. Two new USCRN sites were also installed in Alaska at Gustavus and Tok (near the Tetlin National Wildlife Refuge) and are in the commissioning process. In addition, a series of five more grid points in Alaska were surveyed as inputs for future sites to be installed in the building seasons of summer 2012 and beyond. The program plans, by current estimates, for the installation of 29 new sites in Alaska by the fiscal year 2018.

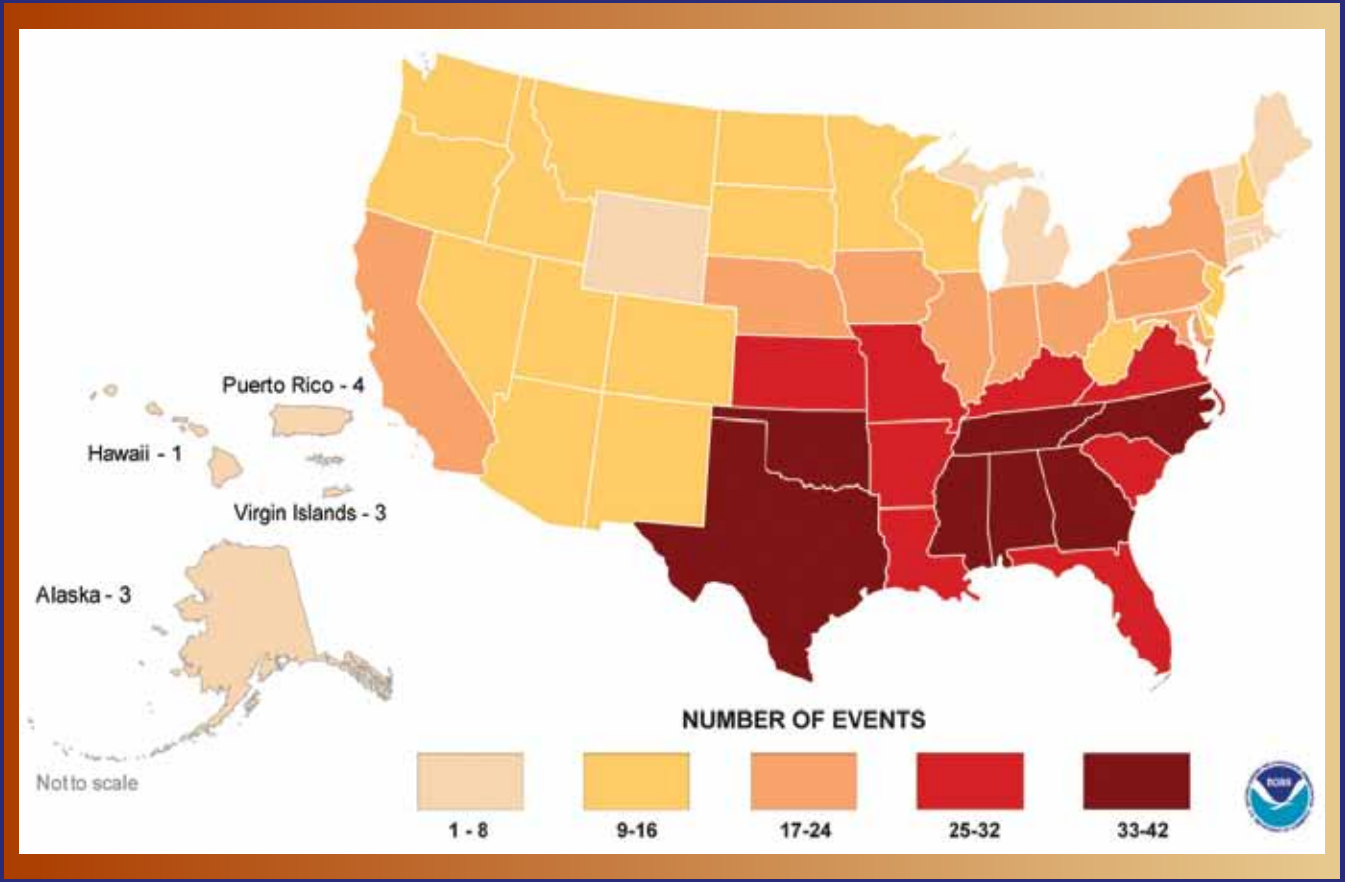
The USCRN fulfills a requirement for obtaining long-term sustainable and robust climate observations that are necessary to document climate change trends for the Nation. Given the fragile nature of the environment in Alaska, installing USCRN stations to monitor climate change in that vast state is essential to advance climate science knowledge as well as to provide important climate monitoring information to the public at large.

Tok, AK

EXTREME COLD WEATHER TESTS NEW CLIMATE REFERENCE NETWORK STATION

The U.S. Climate Reference Network (USCRN) is a network of climate stations that provides high-quality, long-term climate observations of temperature and precipitation. One of the most recent ones installed last year is in the Tetlin National Wildlife Refuge southeast of Tok, AK, and just below the Arctic Circle. It was not long after being installed that the site experienced its first real cold-weather test on Nov. 21, 2011, when a record-breaking early season air mass dropped temperatures at the site down to -50°F. The site, designed with a new fuel cell power supply technology, continued to operate flawlessly throughout the event.

Billion-Dollar Disasters 2011



Billion-Dollar Weather/Climate Disasters 1980–2011

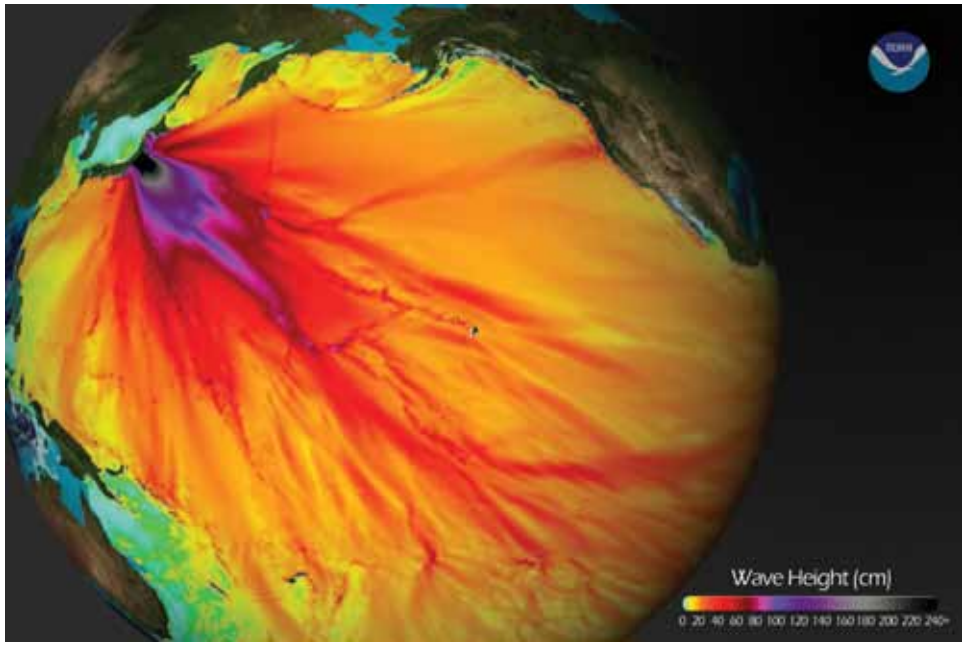
Addressing Billion-Dollar Weather/Climate Disasters

During 2011, the United States set an annual record (since 1980) of 14 individual billion-dollar weather/climate disasters, breaking the previous record of nine disasters, which occurred in 2008. The aggregate damage of these 14 events exceeds $55 billion, which does not set a record for annual losses (record year was 2005). These 14 events included seven severe weather outbreaks with numerous tornadoes, two major flooding events, two tropical cyclones, one wildfire event, one drought/heatwave, and one snowstorm event. The website for this report (http://www.ncdc.noaa.gov/billions) includes a great deal of information and graphics regarding the 2011 events and the overall time series dating from 1980–2011.

Responding to Extreme Climate Events

The year 2011 was marked by a succession of extreme events in the United States and the Fukushima, Japan, earthquake and subsequent nuclear emergency. For each of these major disasters, NCDC provided datasets and real-time monitoring that informed the understanding of both the historical perspective and range of climatological factors relevant to each event.

NCDC provided real-time monitoring and climate services support related to the many additional billion-dollar disasters that unfolded over the course of 2011. NCDC tools and reports helped define, in real time, the magnitude and extent of the severe drought in the Southern United States and Northern Mexico. The U.S. Drought Portal, housed and operated at NCDC, provided a constant stream of information related to the episode, including regular updates of the Drought Monitors that cover the United States and North America. NCDC's climate monitoring efforts provided key insights into the severity of the episode: that the drought had reached historic intensity by late summer, that Oklahoma and Texas recorded the hottest summers observed by any state since recordkeeping began, and that long-term drought conditions persisted despite the short-term benefits of late-year rains.



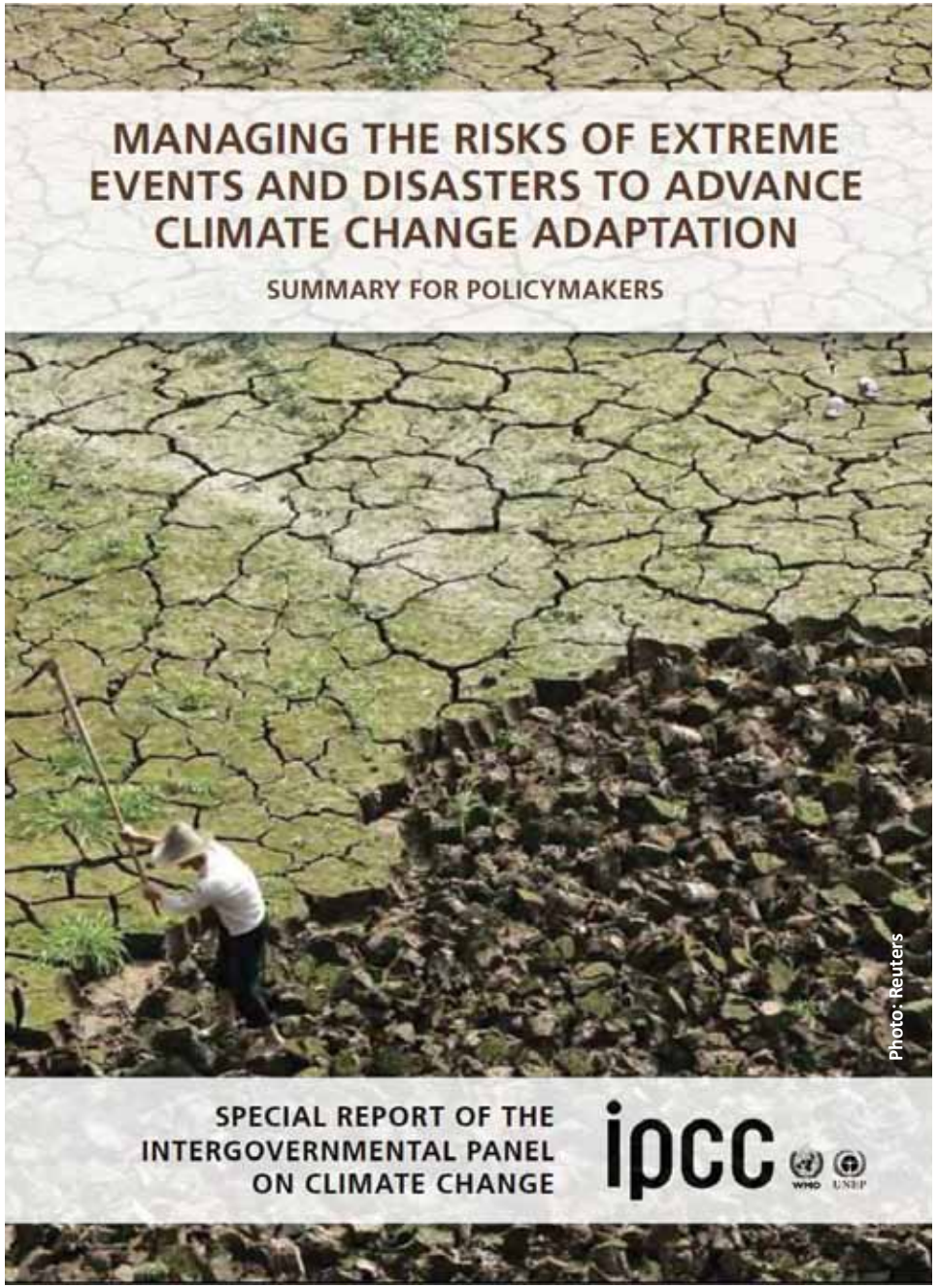
Tsunami wave heights in the Pacific, as modeled by NOAA; notice how the force of the tsunami is focused across the center of the Pacific

In mid-March, as worldwide attention turned toward the damaged reactors during the days following the Fukushima earthquake, NCDC personnel and datasets provided information to the White House Office of Science and Technology Policy on the prevailing springtime winds over Japan. NCDC datasets established relationships with other agencies and painted a picture of what to expect—and the range of possibilities—for both near-surface winds and upper-atmosphere winds.

NCDC provided information that was credible, timely, and scientifically proven in response to the extreme events of 2011. Knowing how these extreme events "fit" with past behavior is a large part of dealing tactically with the immediate consequences and developing more strategic approaches of adaptation to new and evolving climate realities.

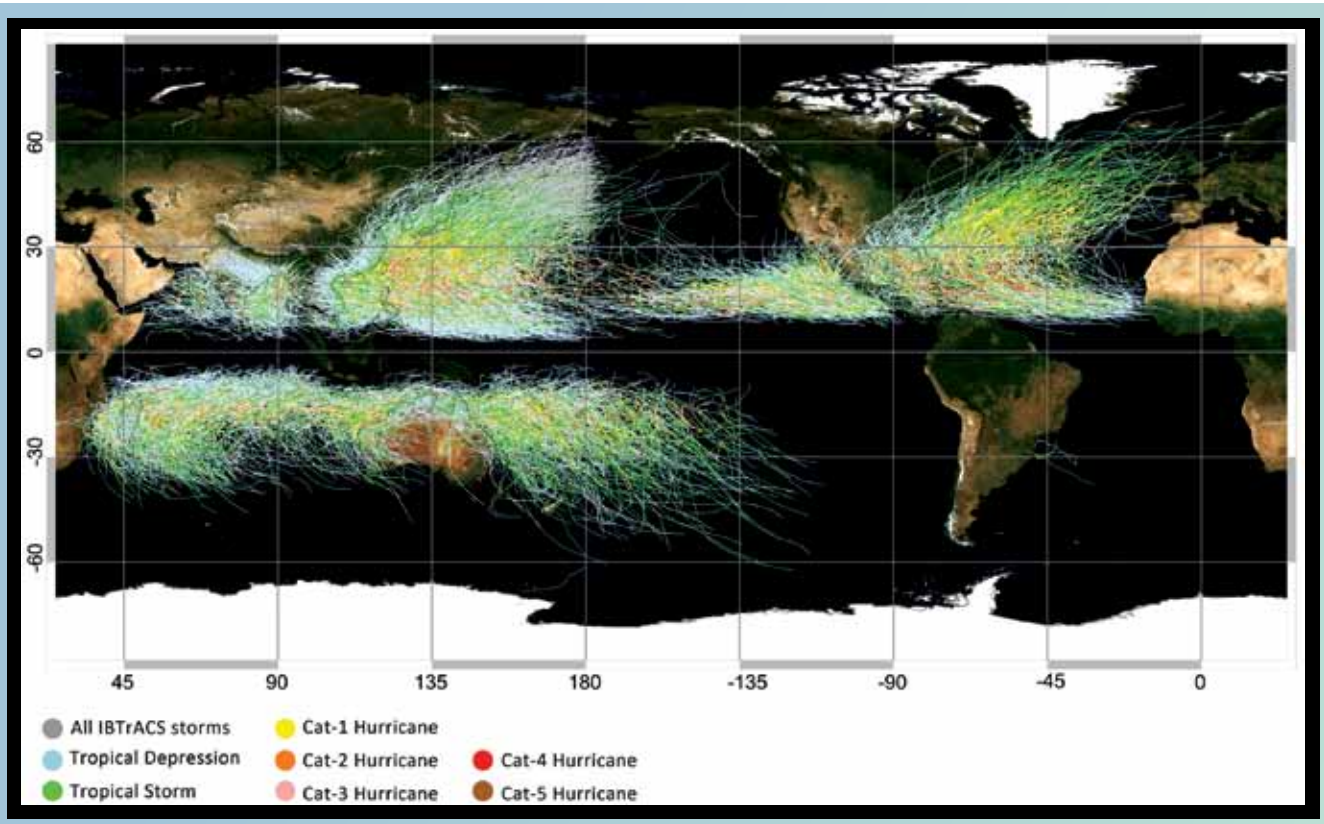
Assessing Climate Change with Respect to Extremes

In 2008, the Intergovernmental Panel on Climate Change (IPCC) commissioned a special report examining changes in extreme weather and climate events and how these changes impact disaster risk management. Two NCDC scientists, Dr. David Easterling and Dr. James Kossin, participated as lead authors on Chapter 3 of the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), the IPCC Working Group I chapter on the physical basis for observed and projected changes in extremes. As lead authors, these scientists were responsible for soliciting input from contributing authors, preparing text and graphics, as well as responding to reviewer comments for a major subsection of the chapter. The SREX report is the culmination of the collective effort of more than 100 authors from the international community and provides the most comprehensive and up-to-date assessment of the science of climate change with respect to climate extremes. The Summary for Policy Makers was released in November 2011, and the full report was released in March 2012. Assessments of climate change, like the SREX report, are important tools for communicating the current state of the science and confidence in conclusions on climate change to decision makers and the public. The SREX comprehensively assesses how climate change alters the characteristics of extreme events in conjunction with a wide range of options used by institutions, organizations, and communities to reduce exposure and vulnerability to and improve resilience to climate extremes.



Updating the World's Premier Collection of Tropical Cyclone Data—International Best Track Archive for Climate Stewardship

The International Best Track Archive for Climate Stewardship (IBTrACS) is the largest collection of hurricane track data and the first centralized repository for such data. Derived from 14 sources and updated annually, IBTrACS contains over 10,000 storms from 1848 to the present. NCDC's new release of IBTrACS in 2011 featured updated tropical cyclone data from all of the World Meteorological Organization forecast agencies as well as from the Joint Typhoon Warning Center, Hong Kong and Shanghai, through 2010. New wind parameters describing tropical cyclone size and the radii of the 34kt and 64kt winds are now available for more storms in the dataset. The metadata has also increased in quantity and quality. To date, the NCDC staff have published over a half dozen peer-reviewed papers on the dataset and hosted two international workshops to promote the dataset and to emphasize the need for improved stewardship and future collaboration.



Global track map of all tropical cyclones since 1848

Observing Global Warming in an Independent Record of the Last 130 Years

As part of NCDC's larger effort to archive and steward many different types of climate information, scientists produced an independent record of global temperature over the last 130 years from paleoclimate proxies (ice cores, tree rings, ocean sediments, and other natural recorders) to compare to the existing surface temperature record from land-based stations and ocean observations. This paleoclimate record confirms the warming trend observed in the NOAA merged land ocean surface temperature dataset, shows the global character of the warming trend, and reveals acceleration of the warming in recent decades.


Ice Cores


NOAA Coastal Habitat Sea Grant Program

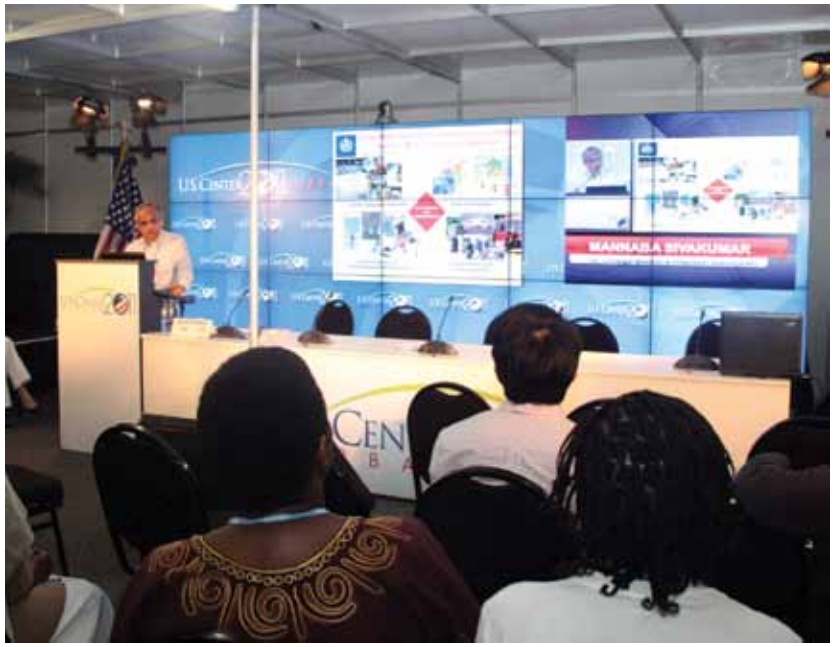

Ocean Sediments

For this project, NCDC collected data produced by scientists working at institutions around the world who publish records of climate and environmental change obtained from proxy evidence. NCDC scientists compiled a set of paleo observations that overlapped the instrumental period. This project involved searching the literature, contacting investigators, mining NOAA and other data sources, and expanding the data archive. The data produced by this project will be archived and distributed by NOAA, and companion efforts are planned for other variables where the instrumental record of climate is even shorter.

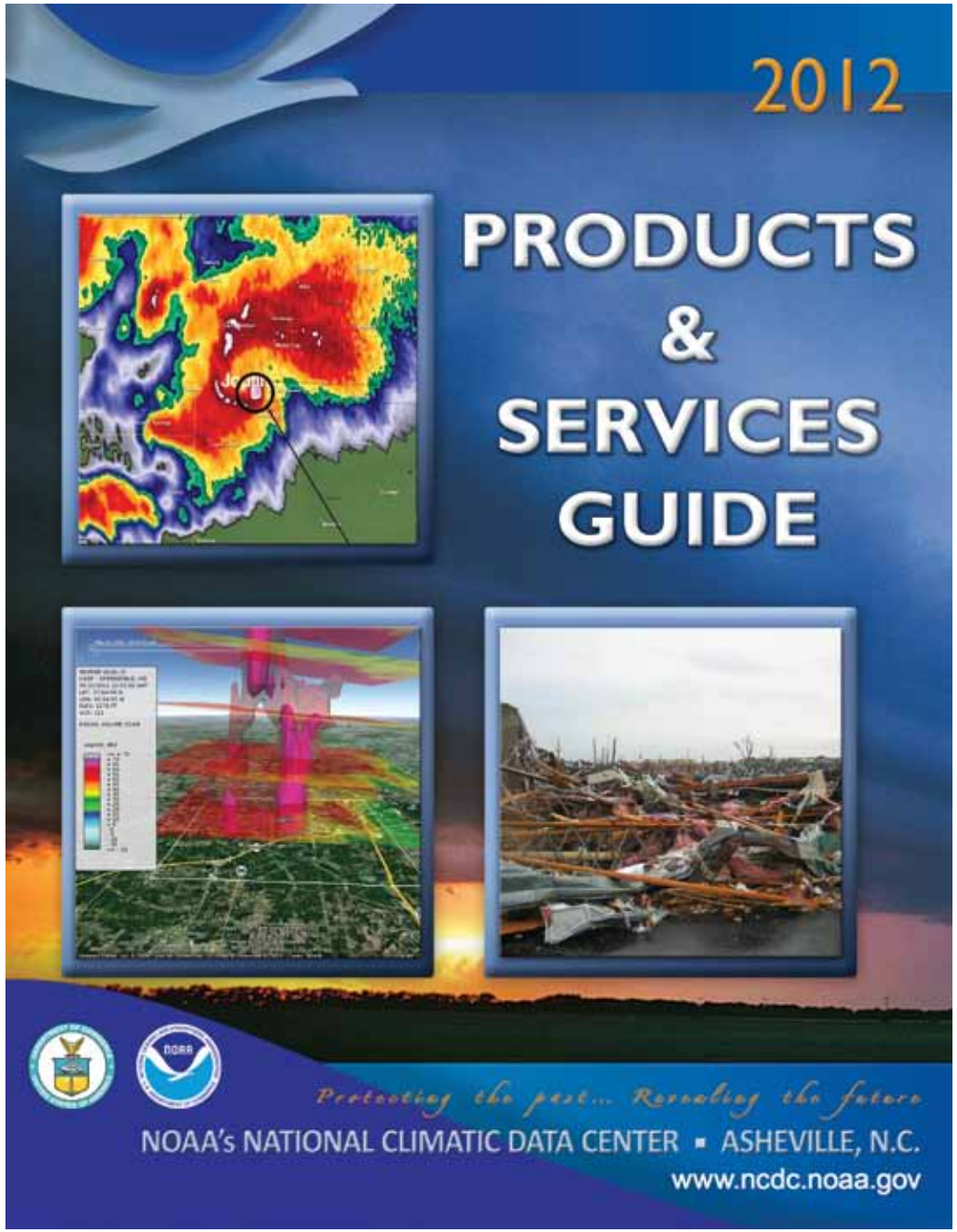
Implementing the Global Drought Monitoring Web Portal

In a global economy, the impacts of drought in one region can be experienced thousands of miles away in the form of escalating prices for food or natural resources. Therefore, NCDC, in coordination with the World Meteorological Organization (WMO), expanded the existing IT infrastructure servicing the U.S. Drought Portal to develop an international clearinghouse to monitor drought based upon local input and products. The resulting Global Drought Monitoring Portal (GDMP) was built using existing technology and tools that provide data and information to U.S. water resource and drought decision makers. The GDMP now serves as the foundation for WMO objectives to build a Global Drought Information System (GDIS) and a Global Drought Early Warning System (GDEWS).

NCDC coordinated with the WMO to ensure that the GDMP is consistent with and contributes to satisfying WMO recommendations for monitoring meteorological drought. The process of building and maintaining the GDMP relies on a partnership of interested countries and regions around the world. The GDMP provides the best assessment of drought on a global basis by engaging local and regional partners to assess their own conditions and feed them up to an international system. Moreover, the GDMP leverages the "best of breed" from *in situ* and remotely sensed data to provide a snapshot of global drought, while allowing decision makers access to regional and national products with additional specificity. Furthermore, the GDMP is collaborating with the WMO to begin incorporating forecasting information to take the next step toward the GDIS.



NOAA and WMO gave a joint presentation on possible improvements to regional cooperation in mitigating droughts worldwide



Launching a Next-Generation Quality Control System for U.S. Summary of the Day Data

For decades, NCDC relied on a quality control (QC) system for the daily summary climate data product that was manually intensive, subjective, frequently delayed, and unresponsive to new science. Over time, these problems resulted in lengthy operational and critical dataset provision delays. This year NCDC launched a new, innovative process for quality control, replacing this 1950s methodology. Data for this daily summary climate data product are collected from more than 8,000 climate stations in the United States and Puerto Rico.

The team worked with users to understand existing problems and user needs for a new system and, based on this feedback, designed fully automated QC algorithms. Once there was a prototype, the group developed, tested, and deployed the new software systems. The final system enables users to easily understand the data and track any changes to the system, which was not possible in the previous system. With the launch of the new system, users can access climate data and information in one third of the time, with accurate and consistent quality control, complete data provenance and version control, and the ability to reassess the full period of record.

Enhancing Data Producer-Archive Collaboration to Improve NOAA's Archive Services

NCDC provides long-term data preservation and access to NOAA's key environmental data. A key goal of NCDC is to accurately preserve a complete understanding of data so that future users can fully use the data independent of assistance from the Data Producer. Coordination of Data Producers and the NOAA Archive in the early stages of data management to ensure establishment of proper data, metadata, documentation, and level of service is the only way to achieve this goal.

NCDC collaboration with the NOAA satellite Data Producers including the ground systems, mission programs, algorithm teams, and IT personnel has increased, thereby improving preservation of NOAA's key environmental data products. Currently, NCDC is supporting more than 12 established National Polar-orbiting Partnership/Joint Polar Satellite System (NPP/JPSS) Working Groups and Review Boards and seven Geostationary Operational Environmental Satellite–R Series (GOES–R) Team meetings. NCDC hosted the NPP/JPSS User Conclave/Customer Forum to improve communication and mutual understanding of common goals. To support Data Producer archive requests, NCDC developed an interface for Advanced Tracking and Resource tool for Archive Collections (ATRAC) in collaboration with the National Geophysical Data Center and the National Oceanographic Data Center. Collaboration regarding all aspects of data management and preservation has significantly improved archive services for future data users.

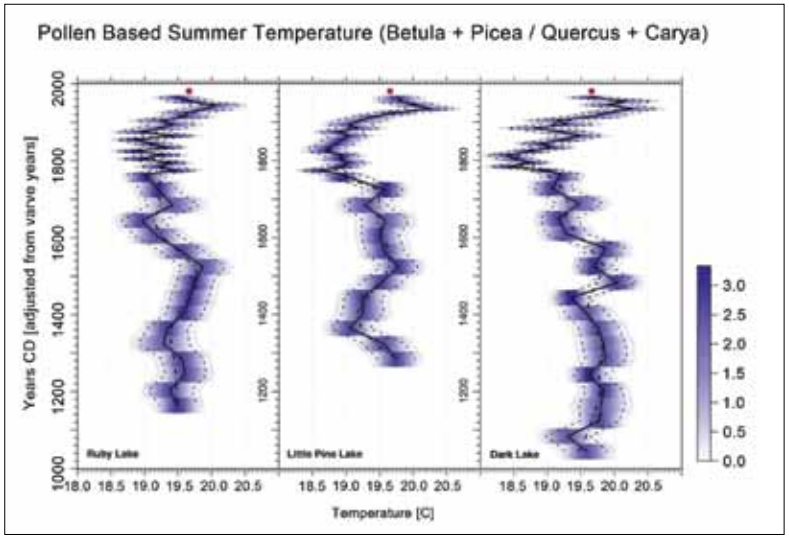
The long-term preservation of, and access to, essential and irreplaceable data of NOAA's key environmental data products have been ensured. The Archive is ready to receive, preserve, and distribute the irreplaceable and highly valuable data from the NPP satellite, which launched in October 2011. Climate forecasts from NOAA's numerical modelers are preserved and distributed for use by industry, resource managers, and the public. The Archive is more efficiently and economically engaged with the NPP/JPSS, the Global Change Observation Mission–Water (GCOM-W1), and GOES-R satellite programs.

An image taken by the NPP Visible Infrared Imager Radiometer Suite (VIIRS) on Nov. 21, 2011. This high-resolution image is wrapped on a globe and shows a broad swath of Eastern North America from Canada's Hudson Bay past Florida to the northern coast of Venezuela. The NASA NPP Team at the Space Science and Engineering Center, UW-Madison created the image using 3 channels (red, green, and blue) of VIIRS data.

Credit: NASA/NPP Team

Increasing Understanding of Extreme Event Variability

To aid the U.S. National Climate Assessment in understanding extremes better, NCDC and the Cooperative Institute for Climate and Satellites-North Carolina hosted two workshops that brought leading scientists in the field together to determine how best to assess the state of the science of understanding long-term variability and changes in various types of extreme events. The first workshop focused on severe localized storms including severe convective storms (tornadoes, hail, severe thunderstorms), extreme precipitation, hurricanes and typhoons, and severe snowstorms and ice storms. The second workshop focused on the larger-scale phenomena of heat waves, cold waves, floods, and drought. Each workshop served as the basis for a peer-reviewed paper authored by the participants and subsequently submitted to the *Bulletin of the American Meteorological Society* for publication.



Reconstruction of summer (JJA) surface temperature in central North America over the past millennium, based on pollen preserved in varve (sediments) at Ruby Lake, Little Pine Lake, and Dark Lake, Wisconsin, USA. Blue shading shows the estimated probability density for temperature; dashed/dotted lines indicate the 95/99% probability ranges of the reconstructions; the red dot represents the modern long-term mean (1961-1990) in the vicinity of the lakes; the smoothed (dashed-dotted) line is a lowess fit of the ensemble median reconstruction (solid line).

Figure 1 from Ohlwein, Christian and Wahl, Eugene, 2012, "Review of probabilistic pollen-climate transfer methods", *Quaternary Science Reviews*), 31, 17-29, doi:10.1016/j.quascirev.2011.11.002.

Reducing Uncertainty in Long Temperature Time Series

In response to the need for development of statistically sophisticated methods for characterization of uncertainty in paleoclimate reconstructions, NCDC scientists developed and published new statistical methods and applied these methods to the last-millennium and full-Holocene (last 12,000 years) datasets in the United States. The results give better characterization of the transition between relatively warm medieval times and the Little Ice Age cool period in north-central North America as well as clear delineation of the western boundary of the North American monsoon circulation in the early Holocene. Uncertainty estimates were added to many of the paleoclimate reconstructions distributed by NOAA. Additionally, techniques from post-processing of weather ensemble forecasts were applied to the north-central reconstructions, representing a first use of this kind of technique in pollen-based paleoclimatology. Together, these activities of developing new methods, adding uncertainty to existing data, and pioneering new techniques make paleoclimate data more valuable in climate change research.

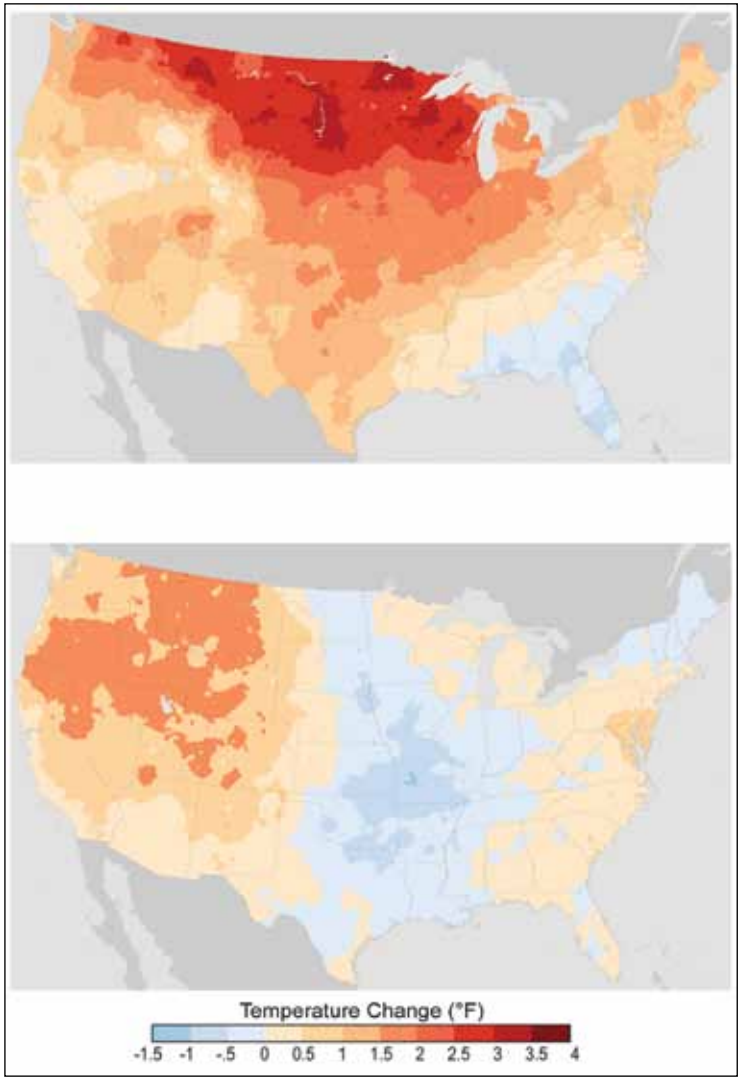
Contributing to Tropical Cyclone Cooperative Activities

In 2011, NCDC staff completed the NOAA Fact Sheet on Tropical Cyclones for public use. These personnel also participated in the U.S. Climate Variability and Predictability (CLIVAR) Hurricane Working Group, which examined the influence of climate variability on tropical cyclones. Additionally, NCDC coordinated a workshop for more than 40 international participants to discuss tropical cyclone data quality. The contributions from this workshop resulted in improvement of the international tropical cyclone data collections and led to a greater understanding of tropical cyclones and their impacts. These contributions will also improve understanding of climate variability's influence on tropical cyclone occurrence, strength, and impacts.

Developing Climate-Related Planting Zone Maps

NCDC prepared maps of climate-related planting zones for the American Public Gardens Association (APGA) and worked with APGA to develop climate related information that the association used in several gardens around the Nation. The maps show how changes in average annual minimum and maximum temperatures affect climate-related planting zones. Three maps were prepared: one for the 1971–2000 normals period, one for the current 1981–2010 normals period, and a projection for the 2011–2040 normals period. This information can help gardeners, landscapers, and farmers identify which plant species will best survive in certain conditions and how conditions might change in the future.

Changes in U.S. Normal Temperatures (1981-2010 Compared to 1971-2000)



Across much of the country, overnight low temperatures in January are as much as several degrees warmer in the 1981–2010 Normals than they were in the 1971-2000 version (top). Meanwhile, the average maximum temperatures in July are actually cooler across some parts of the country (bottom). (Maps by NOAA.)

Managing and Tracking Data Archival Requests with a New Interactive Tool

In 2011, NCDC, in cooperation with its sister data centers—the National Oceanographic Data Center and the National Geophysical Data Center (NGDC)—developed and released the Advanced Tracking and Resource tool for Archive Collections (ATRAC). ATRAC is a web-based tool for managing and tracking data archival requests and is used by NCDC and NGDC for recording and tracking purposes.

ATRAC now offers data providers as well as the NOAA data center stewards an interactive tool for initializing and tracking data archive requests through replacing a process that was often long, detailed, and confusing to non-archive employees. The new approach and interface will permit a better, standardized, and more efficient archive experience and may lead to a greater and more expansive use of NOAA's archive services.

Transitioning the Comprehensive Large Array-Data Stewardship System Program

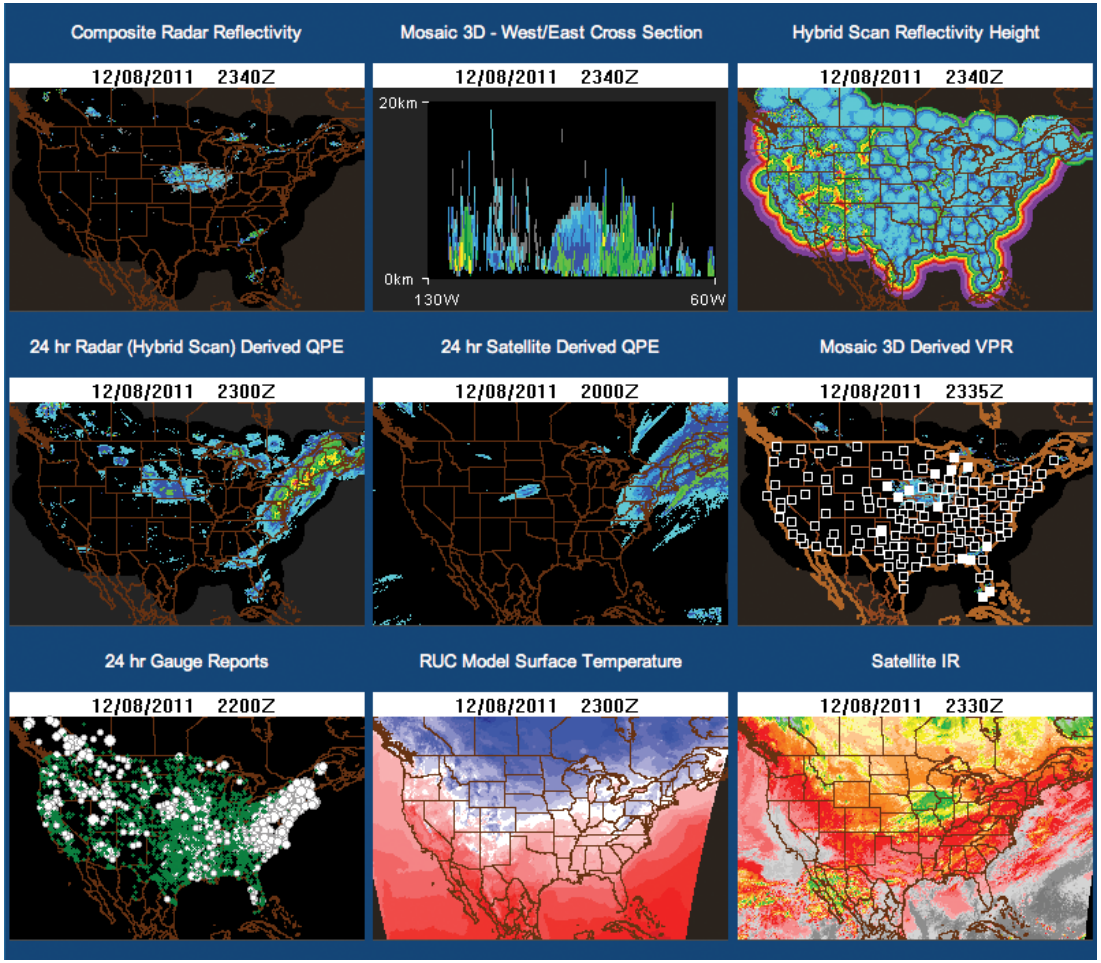
The NCDC transition team, established in 2011, successfully relocated the Program Management of the Comprehensive Large Array-data Stewardship System (CLASS) to the National Climatic Data Center from a sister agency in NOAA. NCDC hired a new CLASS Program Manager and staffed the Program Management Office. The development of CLASS will now be more easily aligned with the operational needs and requirements of NOAA's Data Centers, as development of the system and its operation are conducted side-by-side within NCDC.

NOAA artists rendition: Credit Lockheed Martin

Developing the National Mosaic and Multi-Sensor Quantitative Precipitation Estimation Regional Pilot

As part of a reanalysis of high-resolution next-generation weather radar (NEXRAD) data, NCDC and the Cooperative Institute for Climate and Satellites (CICS) successfully transferred algorithms related to the operational processing part of the National Mosaic and Multi-sensor Quantitative Precipitation Estimation to NCDC from the National Severe Storms Lab (NSSL). This effort included processing many years of archived NEXRAD data using the NSSL algorithms and the processing capabilities of NCDC, CICS, and the Renaissance Computing Institute of the University of North Carolina. This work resulted in the completion of operational reprocessing of rainfall data using NEXRAD and computation of a high-resolution 15-year climatology for the Carolinas.

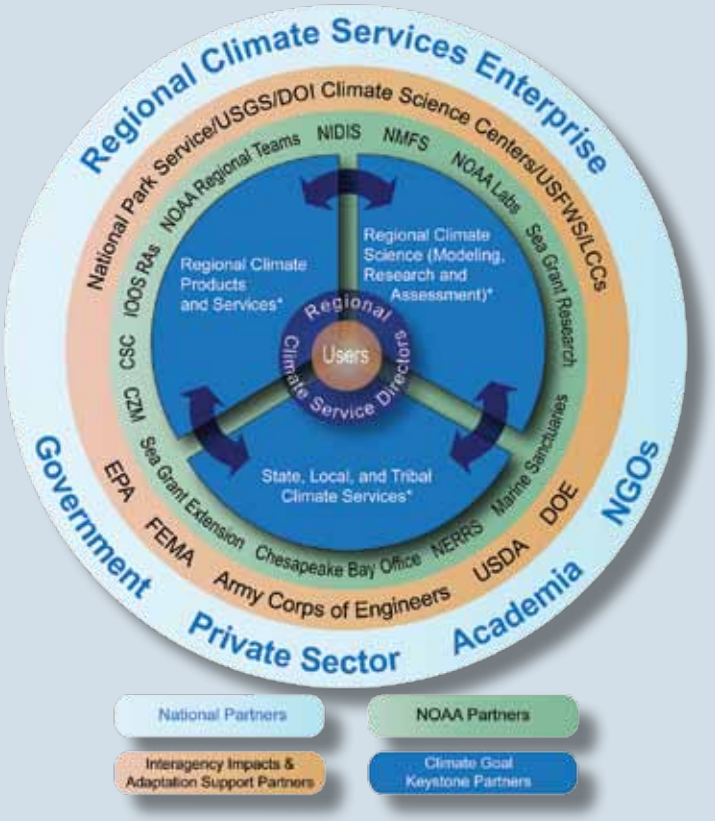
This high-resolution precipitation product permits many new types of hydrological and meteorological analyses and contributions. These data will be extremely valuable for water managers and infrastructure (drainage and sewer systems; reservoirs) planning. The project, which was carried out for the southeastern United States, will provide valuable precipitation information for NASA's Global Precipitation Measurement mission and NOAA's Hydrometeorological Testbed as well as many others. The pilot project is also paving the way for a similarly valuable reprocessing of NEXRAD data for the continental United States.



The National Mosaic and Multi-Sensor QPE (NMQ) system mosaics all 130 National Weather Service and Department of Defense weather radars across the U.S. to provide high resolution depiction of storms and quantitative precipitation estimation in real time

Creating Regional Climate Services Steering Committees

After the establishment of the six Regional Climate Services Directors (RCSDs), each RCSD formed a steering committee to assist their region in discussing and evaluating emerging regional needs. For example, the RCSD–Southern Region led the first NOAA regional climate coordination meeting for the Southern Region on September 19 and 20, 2011, in Baton Rouge. Hosted at the Southern Regional Climate Center, the meeting brought NOAA partners such as Sea Grant, the National Marine Sanctuary Program, and NOAA Data Centers together with external partners, such as the Department of Interior, to discuss regional needs and the formation of an external steering committee. The meeting provided valuable feedback for the Southern Region needs assessment and draft action plan in the fiscal year 2012.



Regional Climate Services Partnership will rely on a network of federal and non-federal partners to deliver regionally-relevant climate information and services to users

In the Eastern region, the RCSD worked with several different groups to assess regional needs for climate information. At the Federal interagency level, the RCSD–Eastern Region led climate teams within the New England Federal Partners and the Federal Climate Partners for New York/New Jersey. Within NOAA and with our close partners (including Sea Grant, the Regional Climate Centers, the Regional Integrated Sciences and Assessments, and the state climatologists), the RCSD–Eastern Region and the Eastern Region Climate Team participated in the development of the regional needs assessments and the data analysis required to move towards collaborative regional projects.

Creation of these committees allows for broad sharing of regional climate information and products from NOAA and for the development of communities that work together and share information to address region-specific issues. By raising the visibility of NOAA's regional climate services, through the use of these steering committees, decision makers and stakeholders now have a better understanding of NOAA points of contact for timely and accurate climate information. The creation of the RCSD steering committees has also prompted the inclusion of RCSD membership on many other Federal steering committees such as the Department of Interior Landscape Conservation Cooperatives and Climate Science Centers.

Supporting the National Climate Assessment

In its second year at NCDC, NOAA's Assessment Technical Support Unit (TSU) continued to provide critical input and support to the National Climate Assessment (NCA) coordinated by the U.S. Global Change Research Program (USGCRP). The NCA, conducted under the auspices of the Global Change Research Act of 1990, calls for a report to the President and Congress that evaluates, integrates, and interprets the findings of the federal Global Change Research Program every four years.

As the 13 U.S. agencies comprising the USGCRP seek to establish an ongoing, sustainable assessment process, as well as deliver a timely report in 2013, NCDC's TSU and the staff at USGCRP work in concert to provide coordination and technical support to a wide network of interagency and external groups and individuals. The TSU has coordinated and facilitated several meetings of the National Climate Assessment Development and Advisory Committee—the federal advisory committee for the NCA—as well as a series of workshops held to develop technical input to the NCA. Scientific support staff also produced regional climatologies and projected, high-resolution outlooks for each of the eight NCA geographic regions. Additionally, they fulfilled several requests for new scientific analyses from various regional and sectoral teams working to provide technical input to the NCA.

The TSU also began to lead development of an interagency "Global Change Information System" initially focused on providing web access to the NCA, but also ensuring robust traceability of sources, connecting to other climate and environmental information across the Government and elsewhere, and using innovative data access methods. This web-focused activity of the NCA will serve as a key component of the ongoing, sustainable assessment process. Early progress included redeploying the 2009 "Global Climate Change in the United States" report to test some principles of traceability and searchability, developing collaborative work spaces for the approximately 250 authors and more than two dozen technical input teams, and facilitating upload of over 120 technical inputs to the process.

At the regional level, NOAA's Regional Climate Services Directors (RCSDs) in all of the six regions organized and participated in meetings to draft the technical input for the National Climate Assessment. In addition to co-leading regional meetings, several of the RCSDs served as contributing authors for the technical inputs provided to the national committee on March 1, 2012. RCSDs are also the NOAA representatives, and in some regions the lead, for developing and fostering the ongoing sustainable process at the regional level.

Moving Toward a Ninety-Day Storminess Outlook for Alaska

Storms represent high-impact weather events in Alaska, and Alaska's extensive coastline makes the region especially vulnerable to coastal flooding and erosion, particularly where there is no protective sea ice buffer. These coastal communities are in major need of an expanded temporal range of storm outlooks to enable proactive responses to these potentially devastating storms. Currently, NOAA's Climate Prediction Center Storm Tracks website includes summaries of storm tracks and accumulated precipitation for the past 10-, 30-, and 90-day periods, together with week-one and week-two forecast storm tracks from the Global Forecast System's (GFS) operational run and the GFS ensemble. NCDC is working to extend this window of storm outlook to 90 days by drawing upon the present states of the El Niño Southern Oscillation, the Pacific Decadal Oscillation, and the Arctic Oscillation—three large-scale modes of variability known to affect Alaska. NCDC, in conjunction with the NOAA Cooperative Institute for Alaska Research, is leading research and development efforts and coordinating with the University of Alaska Fairbanks, the University of Victoria British Columbia, the University of Hawaii, Alaska and the Pacific Regional Climate Service Directors, the National Weather Service Alaska Region, and many others. NCDC's goal is to provide both data provision and archive services to the region.
The success of this project in Alaska will lead to the progression of the project to include the Pacific and Western regions.

USGS researcher Benjamin Jones measures erosion along a part of Alaska's Arctic coast; on the left side of the photo is an example of a collapsed block of ice-rich permafrost Courtesy of Christopher Arp, USGS

Enhancing Regional Collaboration through Web Development

To enhance collaboration and provide access to critical data, research, and climate information among regional institutions and programs involved in climate services, NCDC is developing a Regional Climate Services Website. Initial developments in the Pacific region, including the Pacific Climate Information System (PaCIS), may be adapted to other regions. PaCIS provides NOAA and its partners with strategic guidance for the development and implementation of an integrated program of climate observations, research, modeling, forecasting, operational services, assessment, information management, and education and outreach. NCDC developed another online repository, PacificIslandsClimate.org (PIKO), as a gateway to a broad range of information related to climate in the Pacific Islands. PIKO includes summaries of programs, projects, and activities, as well as products and services. An online database similar to PIKO is also under development for the Eastern Region. Another portion of the regional web development, Pacific Storms Climatology Products, provides access to an integrated suite of products that delineate patterns and trends of storm frequency and intensity within the Pacific. All of these web development efforts aim to heighten cooperation and provide communities with the needed information to respond to their climate concerns.

Establishing a New Operational Processing Capability

NCDC established a significant new operational processing capacity for the routine processing of data from NCDC's archive into derived, value-added products, including Climate Data Records (CDRs). This increased high-performance production system is now capable of supporting NOAA's emerging requirements for developing operational satellite-based CDRs, while at the same time reducing the electrical footprint used by the Center.

This new operational processing capacity will allow easier production of value-added products from NOAA's archived datasets as well as routine processing and delivering of CDRs from a secure operational environment. Additionally, NOAA/NCDC researchers now have a better-defined and efficient pathway to the operational production of new and valuable data products. This enhancement will lead to the routine production and near-real-time processing of a greater variety of CDRs for application to ongoing and evolving climate events on sub-seasonal to seasonal time scales.

Advancing the Cooperative Institute for Climate and Satellites-North Carolina

With nearly three years completed, the Cooperative Institute for Climate and Satellites-North Carolina (CICS-NC) is active and operational with a team of 25 researchers supporting the NCDC mission of enhancing the collective interdisciplinary understanding of the state and evolution of the full Earth system. Over the past year, CICS-NC research activities, spanning seven key themes, have grown and advanced. CICS-NC researchers published more than 25 peer-reviewed papers and gave over 60 presentations at several dozen conferences, meetings, and workshops on the topics of climate research and applications, satellite and observation monitoring, and climate modeling.

Additionally, the CICS-NC staff continues to demonstrate leadership and drive innovation, both nationally and internationally, through contributions to the IPCC Fifth Assessment Report, the International Surface Temperature Initiative, the Global Climate Observing System Working Group on Atmospheric Reference Observations, and the AMS Energy Committee. In the past year, CICS-NC has also led or assisted in the organization of several workshops including the Statistical and Applied Mathematical Sciences Institute Uncertainty Quantification Workshop, the Cooperative Research Program Science Symposium, and the CICS-NC Science Meeting. CICS-NC continues to cultivate activities in literacy and outreach, including developing a framework for routine engagement with the private sector to advance the uptake of climate data and develop cutting-edge techniques in climate communications.

GOLD MEDAL AWARD

James Kossin

For excellence in research and data stewardship leading to a more confident assessment of the influence of human-induced climate change on hurricanes (one of many recognized in a group award by the Office of Oceanic and Atmospheric Research).

BRONZE MEDAL AWARD

Matthew Menne
Imke Durre
Russell Vose
William Angel
Ronald Ray
Billie Faye Maybin
Gloria Anderson
Cheryl Nave
Lila Carr
Theodore T. Burlew, Jr.

For development of and transition to a next-generation quality control system for daily summary climate data for the United States.

Stephen Del Greco
Nancy Ritchey
Alan Hall
Glenn Rutledge
Danny Brinegar
David Bowman
Suranjana Saha (not at NCDC)
Rick Vizbulis (not at NCDC)
Neal Lott

For the novel archive and distribution of NOAA's Climate Forecast System Reanalysis model results to facilitate climate assessments and research.

ADMINISTRATOR'S AWARD

Michael J. Brewer
David R. Easterling
Douglas Kluck
Thomas C. Peterson
Jason Symonds

For support to the Interagency Working Group (NWS) addressing flooding and development of a NOAA Decision Support System for Devils Lake (several of many recognized in a group award by the National Weather Service).

THE PRESIDENTIAL EARLY CAREER AWARD FOR SCIENTIST AND ENGINEERS (PECASE)

The White House named NCDC Scientist, Dr. Anthony Arguez, and two other NOAA scientists as recipients of the 2011 Presidential Early Career Award for Scientists and Engineers (PECASE).

This award is the highest honor given by the U.S. government to outstanding scientists and engineers in the early stages of their careers. Dr. Arguez's PECASE recognizes his work on the development of the next-generation 1981–2010 U.S. Climate Normals, which is cutting-edge from both a climate science and a user engagement perspective. NCDC, NOAA, and the Nation will continue to benefit for years to come from Dr. Arguez's leadership and scientific innovation.

AWARDS

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Partial List of Presentations at Major Conferences

American Geophysical Union Fall Meeting, 5–9 December 2011, San Francisco, CA

Anderson, D.M., E. M. Mauk, E. R. Wahl, C. Morrill, A.J. Wagner, D.R. Easterling, and T. Rutishauser: Global warming in an independent record of the past 130 years.

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Brewer, M., R.R. Heim, W. Pozzi, J. Vogt, and J. Sheffield: The global drought monitor portal: The foundation for a global drought early warning system.

Brown, D.P.: NOAA Regional Climate Services: Southern Region opportunities, challenges, and first steps.

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Guillevic, P.C., J.L. Privette, B. Coudert, E. Davis, T.P. Meyers, M.A. Palecki, J.A. Augustine, and C. Ottle: Land surface temperature product validation using NOAA's surface climate observation networks: Scaling methodology for the Visible Infrared Imager Radiometer Suite (VIIRS).

Hausfather, Z., S. Mosher, M.J. Menne, C.N. Williams, N. Stokes, and D. Jones: The impact of urbanization on global surface temperature trends.

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Johnston, S.S., W.J. Glance, J.J. Bates, and E.J. Kearns: Progress and processes for generating NOAA's climate data records.

Kim, D., and J. Zhang: Adaptive multi-sensor precipitation estimate by using wavelet thresholding approach.

Kunkel, K., and D.R. Easterling: Climate change impacts on probable maximum precipitation.

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Liu, C., R.W. Reynolds, A.D. Hall, and V. Banzon: The Optimum Interpolation Sea Surface Temperature (OISST) from research to operation.
Lowry, D.P., and C. Morrill: Changes in the global hydrological cycle: Lessons from modeling lake levels at the last glacial maximum.
Matthews, J.L., A. Lattanzio, B. Hankins, A. Inamdar, K. Knapp, and J.L. Privette: Surface albedo based on geostationary satellite observations.
Nelson, B.R., O.P. Prat, and E.H. Habib: Diurnal cycle of precipitation in the Southeast U.S. using high spatial and temporal resolution quantitative precipitation estimates and radar-reflectivity products derived from National Mosaic and Multi-sensor QPE (NMQ/Q2).
Owen, Tim: Near-term opportunities for climate adaptation success: An interagency perspective.
Partain, J.L.: Towards a 90-Day monthly storm outlook for Alaska.
Prat, O.P., and B.R. Nelson: Characterization of precipitation extremes at high spatial and temporal resolution in the Southeastern United States derived from long-term satellite and radar rainfall estimates.
Privette, J.L., J.J. Bates, and E.J. Kearns: NOAA's satellite climate data records: The research to operations process and current state.
Rennie, J., A. Wilson, J.H. Lawrimore, R. Ray, and M.J. Menne: Implementing new quality control and processing systems for hourly precipitation data.
Roberts, K., N.A. Ritchey, P. Jones, and H. Brown: An introduction to the Advanced Tracking and Resource Tool for Archive Collections (ATRAC).
Shein, K.A., C. Marzin, J. Hendee, D. Pirhalla, B. Causey, and T.B. Brandon: Integrating climate and ecosystems science to inform marine ecosystem management.
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Wahl, E.R.: Understanding last millennium climate change: Reconstructions, testing climate model response to volcanic forcing, and evaluating efficacy of reconstruction methods.
Wuebbles, D.J., E. Janssen, and K. Kunkel: Severe weather in a changing climate: Getting to adaptation.

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Privette, J.L.: NPOESS preparatory project validation program for land data products from the Visible Infrared Imager Radiometer Suite (VIIRS).
Saunders, D., N. Ritchey, and R. Rank: Accessing NPP data from CLASS, a tutorial.
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Applequist, S., D. R. Easterling, K.E. Kunkel, and G. P. Compo: Extratropical cyclone activity changes over the 20th century.
Applequist, S., A. Arguez, I. Durre, M.F. Squires, R.S. Vose and X. Yin: U.S. climate normals: hourly-derived products.
Arguez, A., S. Applequist, I. Durre, M.F. Squires, R.S. Vose, and X. Yin: U.S. climate normals: an overview.
Arguez, A., S. Applequist, I. Durre, M.F. Squires, R.S. Vose, and X. Yin: U.S. climate normals: temperature and degree days.
Bell, J.E.: An evaluation of air and soil temperature for estimating growing season and growing degree days.
Brewer, M.J., R.R. Heim, Jr., W. Pozzi, J. Vogt, and J. Sheffield: The global drought monitor portal – the foundation for a global drought early warning system.
Crouch, J., T.W.R. Wallis, and D.S. Arndt: A U.S. wind climatology: new tools to monitor wind trends across the contiguous United States.
Durre, I., M.F. Squires, R.S. Vose, S. Applequist, A. Arguez and X. Yin: U.S. climate normals: precipitation, snowfall, and snow depth.
Fenimore, C., K. Gleason, D.S. Arndt, and R.R. Heim, Jr.: Transitioning from the traditional divisional dataset to Global Historical Climatology Network-daily gridded divisional dataset.
Gleason, B.E., C.N Wiliams, Jr., J.H. Lawrimore, M.J. Menne, R.S. Vose and J. Rennie: The Global Historical Climatology Network (GHCN-M), version 3 and 4: Improving the global surface temperature record.

Guillevic, P.C., ..., J.L. Privette, et al.: Development of a methodology to utilize land surface temperature satellite data for climate studies.
Hausfather, Z., M.J. Menne, D. Jones, R. Broberg, T. Masters, and C.N. Williams, Jr.: Assessing the urban heat island signal in the U.S. Historical Climatology Network monthly temperature data.
Leeper, R.: The role of network architecture in surface-based in-situ climate observations.
Lott, N., R. Baldwin, J. Burroughs, J. Boyd, G. Reid, J. Marshall, and G. Sataloff: NOAA's National Climatic Data Center and Coastal Services Center--Enabling data discovery and interoperability.
Menne, M.J., C.N. Williams, Jr., and P. Thorne: Structural uncertainty in the U.S. Historical Climatology Network temperature records.
Palecki, M.: NOAA's in situ climate observing system: maintaining the climate record.
Prat, O.P., and B.R. Nelson: Characterization of precipitation features in the Southeastern United States using a multi-sensor approach – milestones for a longer-term assessment of climate change impacts.
Rennie, J., A. Wilson, J.H. Lawrimore, M.J. Menne, and R. Ray: Implementing new quality control and processing systems for hourly precipitation data.
Schreck, C.J., L. Shi, and J.P. Kossin: The Madden–Julian oscillation and equatorial waves in upper tropospheric water vapor.
Squires, M.F., J.H. Lawrimore, R. Heim, D.A. Robinson, M.R. Gerbush, and T. Estilow: Development of a regional snowfall impact scale and snowstorm database at the National Climatic Data Center.
Stevens, S., B. Nelson, and C. Langston: National Mosaic and Multi-sensor QPE (NMQ) reanalysis in the southeastern United States.

Ninth Conference on Artificial Intelligence and its Applications to the Environmental Sciences, 24–27 January 2011, Seattle, WA (AMS)
Shi, L.: Global atmospheric temperature and humidity profiles based on intersatellite calibrated HIRS measurement.

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Arndt, D.S., A. Arguez, S. Applequist, I. Durre, M Squires, R. Vose, and X. Yin: New temperature and precipitation climate normals.

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Applequist, S., D. R. Easterling, K.E. Kunkel, and G. P. Compo: Analysis of extratropical cyclones in the northern hemisphere using the NOAA historical reanalysis.
Arguez, A., S. Applequist, I. Durre, L Ross, M.F. Squires, R.S Vose, and X. Yin: NOAA's 1981-2010 Climate normals: A preview.
Arndt, D.S., A. Sanchez-Lugo, C. Fenimore, R. R. Heim, Jr., and J. Blunden: The climate of 2010 in historical perspective.
Blunden, J. and D.S. Arndt: Analysis of freezing rain patterns in the south central United States: 1979-2009.
Durre, I. and X. Yin: Enhancements of the data set of sounding parameters derived from the integrated global radiosonde archive.
Fenimore, C., K. Gleason, and R.R. Heim, Jr: Transitioning from the traditional divisional dataset to Global Historical Climatology Network-daily gridded divisional dataset.
Kunkel, K.E., D.R. Easterling, B. Gleason, D.A.R. Kristovich, L. Stoecker, and R.A. Smith: Meteorological causes of observed extreme precipitation trends in the U.S.
Kruk, M.C., E. Gibney, D.H. Levinson, and M.F. Squires: The climatology of inland winds from tropical cyclones in the Eastern United States.
Kruk, M.C., D.H. Levinson, E. Gibney, and P.A. Hennon: What is coastal?
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Levinson, Dave; Kruk, Michael; Marra, John: Assessing climate change and variability in the coastal zone: Overview of the Pacific storms climatology products.
Liu, C., R.W. Reynolds, T. Smith, and P.V. Banzon: Comparison of the NCDC sea surface temperature datasets: ERSST and OISST.
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Brewer, M., J. Symonds, and R. Heim: A global drought monitoring web portal.

Palecki, M.: U.S. Climate Reference Network soil moisture measurements and drought monitoring.

27th Conference on Interactive Information Processing Systems (IIPS), 24–27 January 2011, Seattle, WA (AMS)

Angel, W.E., T.F. Ross, and R. Truesdell: NOAA's Climate Database Modernization Program (CDMP) paving the road for data stewardship.

Ansari, S., S.A. Del Greco, and B. Hankins: The weather and climate toolkit.

Cintineo, J.L., T. Smith, V. Lakshmanan, and S. Ansari: An automated system for processing the Multi-Year Reanalysis Of Remotely-Sensed Storms (MYRORSS).

Del Greco, S.: Weather radar data services at NOAA'S National Climatic Data Center.

Hausman, S.A., and D.R. Jones: NOAA's environmental data management: Commitment to stewarding a national resource.

Hennon, P. A., K.R. Knapp, and J.P. Kossin: Homogeneous tropical cyclone intensities from the Community Dvorak Analysis (CoDA) project.

Hennon, P.A., K.R. Knapp, M.C. Kruk, and D. H. Levinson: Investigating patterns and changes in global tropical cyclone storm frequency and intensity.

Jones, P., K. Roberts, and N. Ritchey: An Introduction to the Advanced Tracking and Resource tool for Archive Collections (ATRAC).

Karl, T.R.: A cornerstone for actionable climate information: data transparency.

Lief, C. and H. Diamond: The essential climate variables (ECV) data access matrix: A quick and convenient method to access global climate datasets.

Lott, N., R. Baldwin, and J. Burroughs: NOAA's National Climatic Data Center and Coastal Services Center--Enabling data discovery and interoperability.

Ritchey, Nancy: Lessons learned from the application of NOAA's "what to archive" process.

Rutledge, G.K.: Plans for the NOAA national climate model portal.

Squires, M.F., J.H. Lawrimore, R.R. Heim, Jr., D.A. Robinson, M.R. Gerbush, T.W. Estilow, L. Ross, and C. Tabor: Regional snowfall impact scale.

First Conference on Transition of Research to Operations: Successes, Plans and Challenges, 24–27 January 2011, Seattle, WA (AMS)

Privette, J.L., J.J. Bates, E. Kearns, D. Wunder, and D. Carter: The evolving research to operations process for NOAA's satellite climate data records.

Second Conference on Weather, Climate, and the New Energy Economy, 24–27 January 2011, Seattle, WA (AMS)

Crouch, J., T.W.R. Wallis, and D.S. Arndt: A U.S. wind climatology: New tools to monitor wind trends across the contiguous United States.

More Effectively Communicating the Science of Tropical Climate and Tropical Cyclones, 24–27 January 2011, Seattle, WA (AMS)

Hennon, P.A., K.R. Knapp, M.C. Kruk, D. H. Levinson, H.J. Diamond, and E. Gibney: Unifying tropical cyclone best track data.

Practical Solutions for a Warming World: AMS Conference on Climate Adaptation, 18–20 July 2011, Asheville, NC (AMS)

Brewer, M.J., M. McGuirk, and D. Tuch: The effects of global climate change on the landscape: the role of landscape architecture in adaptation strategies.

Gleason, K., and D.S. Arndt: The regional U.S. climate extremes index.

Heim, R. R., Jr., M.J. Brewer, W. Pozzi, D. Cripe, and J. Sheffield: The global drought monitor portal—a climate information and decision support tool with global applications.

Kunkel, K.E., and D.R. Eastlering: Potential impacts of climate change on estimates of probable maximum precipitation.

20th Symposium on Education, 24–27 January 2011, Seattle, WA (AMS)

Brown, O., M. McGuirk, F. Miralles-Wilhelm, G. Voos, and J. Dissen: Developing a curriculum for a summer school on climate change.

Freedman, A., H. Cullen, and M. McGuirk: Communicating climate science to the general public.

Peterson, T.C.: Practical Education for Developing Country Scientists: WMO Commission for Climatology experience and perspective.

Sixth Symposium on Policy and Socio-economic Research, 24–27 January 2011, Seattle, WA (AMS)

Hennon, P.A. and K.R. Knapp: A climatology of infrared-based tropical cyclone wind radii, integrated kinetic energy, and damage potential.
Owen, T. W.: Strategies for urban climate change adaptation: The federal perspective.
Smith, A.B.: Insurance loss return periods with extreme event intensity thresholds across the US: 1980-2010.

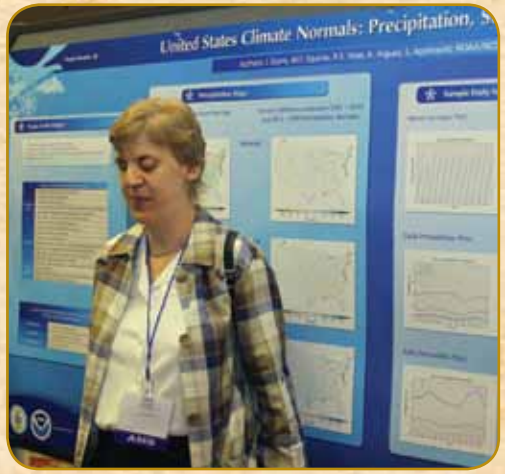
World Climate Research Programme Open Science Conference: Climate Research in Service to Society, 24–28 October 2011, Denver, CO

Anderson, D., E. Mauk, and C. Morrill: Reconstructing climate variability since 1880 through paleoclimate proxies.
Banzon, V., G. Peng, H. Semunegus, L. Shi, and X. Zhao: An introduction to the seven new climate data records.
Brewer, M., R. Heim, W. Pozzi, J. Sheffield, and J. Vogt: The global drought monitor portal: The foundation for a global drought early warning system.
Delju, A.H., T. Peterson, and S. Sensoy: Use of social media in climate science: The Commission for Climatology Facebook experience.
Delju, A.H., T. Peterson, M. Rajeevan, and M.V.K. Sivakumar: Commission for Climatology (CCI): International collaboration and past achievements.
Easterling, D., and K. Kunkel: Potential impacts of climate change on estimates of probable maximum precipitation.
Easterling, D., S. Applequist, G. Compo, K. Kunkel, P. Sardeshmukh, and J. Whitaker: 20th century trends in northern hemisphere extratropical cyclone occurrence.
Easterling, D., L. Ensor, B. Gleason, D. Kristovich, K. Kunkel, R. Smith: Meteorological causes of observed extreme precipitation trends in the U.S.
Groisman, P., T. Karl, and R. Knight: Changes in intense precipitation over the conterminous U.S.: Observational evidence and possible causes.
Gross, W., D. Anderson, B. Bauer, R. Buckner, G. Edward, M. Hartman, C., Morrill, A. Shah, and E. Wahl: Enabling data-intensive science at NOAA's World Data Center for Paleoclimatology.
Karl, T.R.: Scientific grand challenges from the USGCRP perspective. [Keynote]
Kluck, Doug: Devils Lake, ND, adaptation, response & climate attribution: The devils in the details.
Knapp, K., L. Shi, and X. Zhao: Recent accomplishments on satellite climate data records at National Climatic Data Center.
Kossin, J., K. Knapp, C. Schreck, and L. Shi: Continuing development of climate information records at NOAA's National Climatic Data Center.
Lawrimore, J., ... M. Menne, ..., P. Thorne, et al.: The International Surface Temperature Initiative: Global surface databank development.
Morrill, C. and Y.Li: Lake level change at the last glacial maximum and implications for radiative forcing of the hydrologic cycle.
Privette, J., J. Bates, and E. Kearns: Processes for generating and sustaining scientifically defensible climate data records from satellites.
Sensoy, S., and T.C. Peterson, 2011: Use of social media in climate science: The Commission for Climatology Facebook experience.
Thorne, P.: The International Surface Temperature Initiative: Data rescue.
Thorne, P., J. Lawrimore, and K. Willett: The International Surface Temperatures Initiative: An overview.
Weaver, R., J. Privette, and H. Ramapriyan: Long-term records characterizing earth system changes: ESDRs and CDRs.


Dave Smith


Tammy Scott
John Thomas


Welcome


United States Climate Normals: Precipitation,

CREDITS

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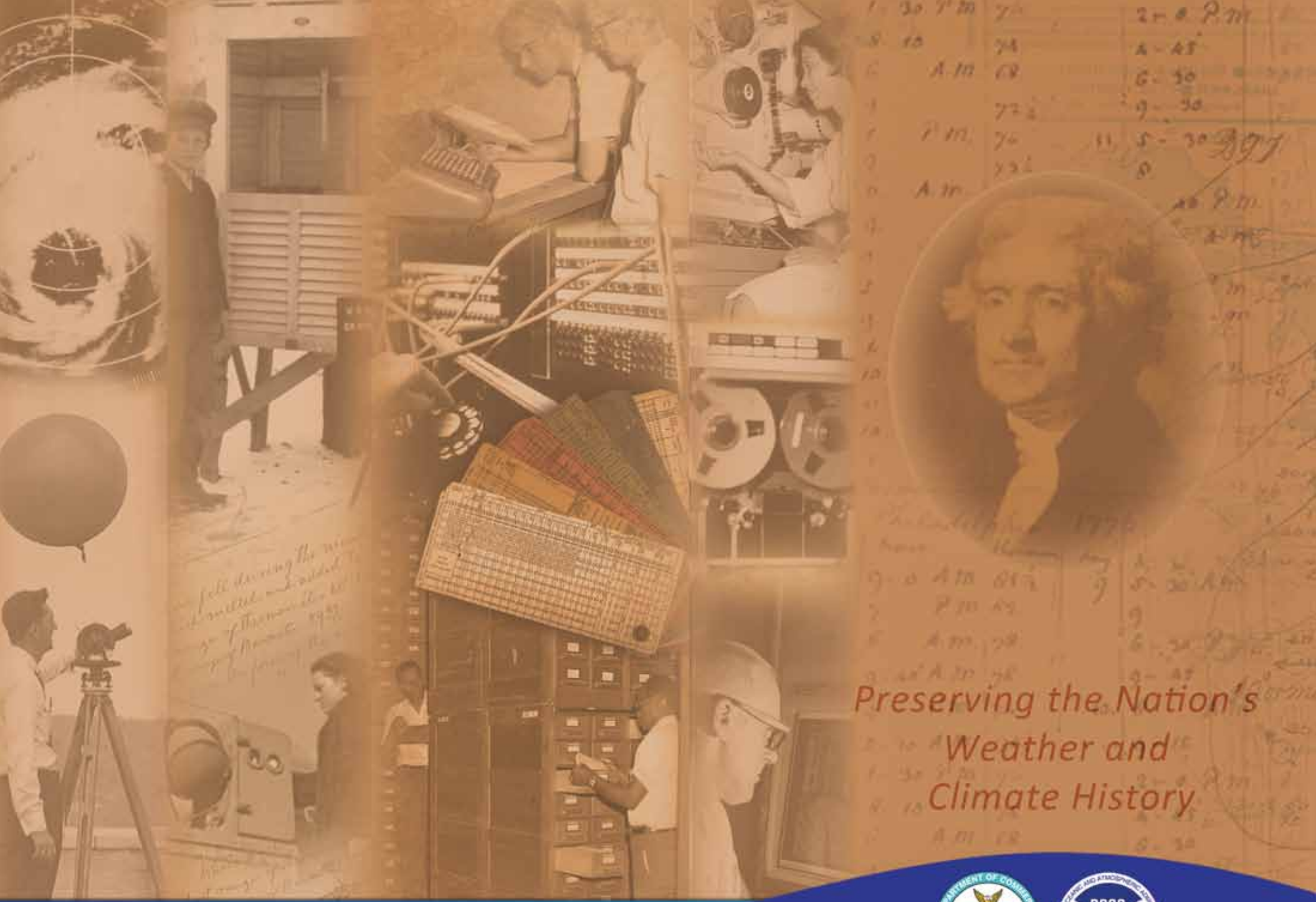

Preserving the Nation's Weather and Climate History

Celebrating 60 years